FIG. 1a

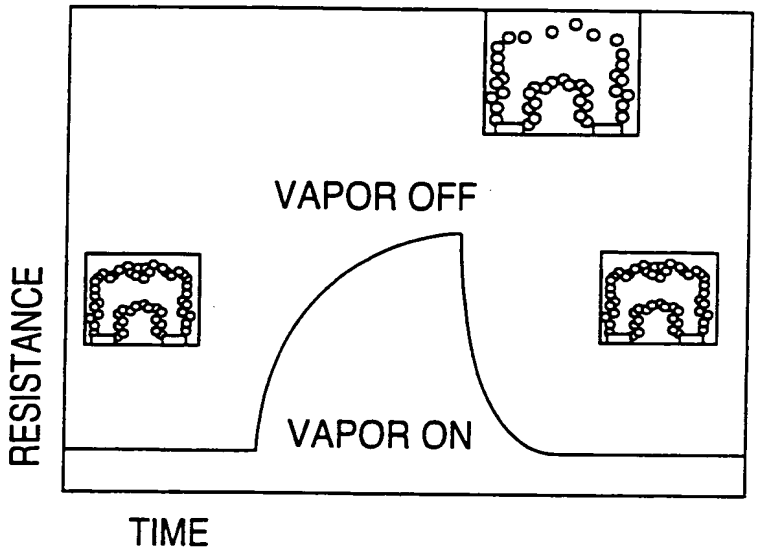


FIG. 1b

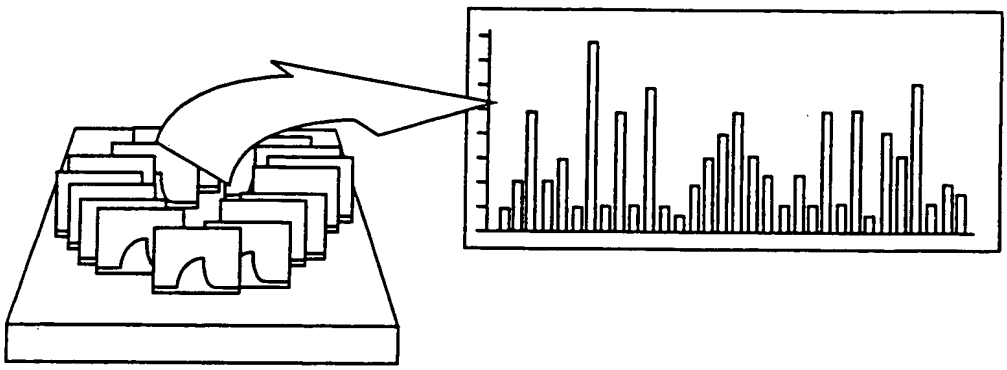


FIG. 2

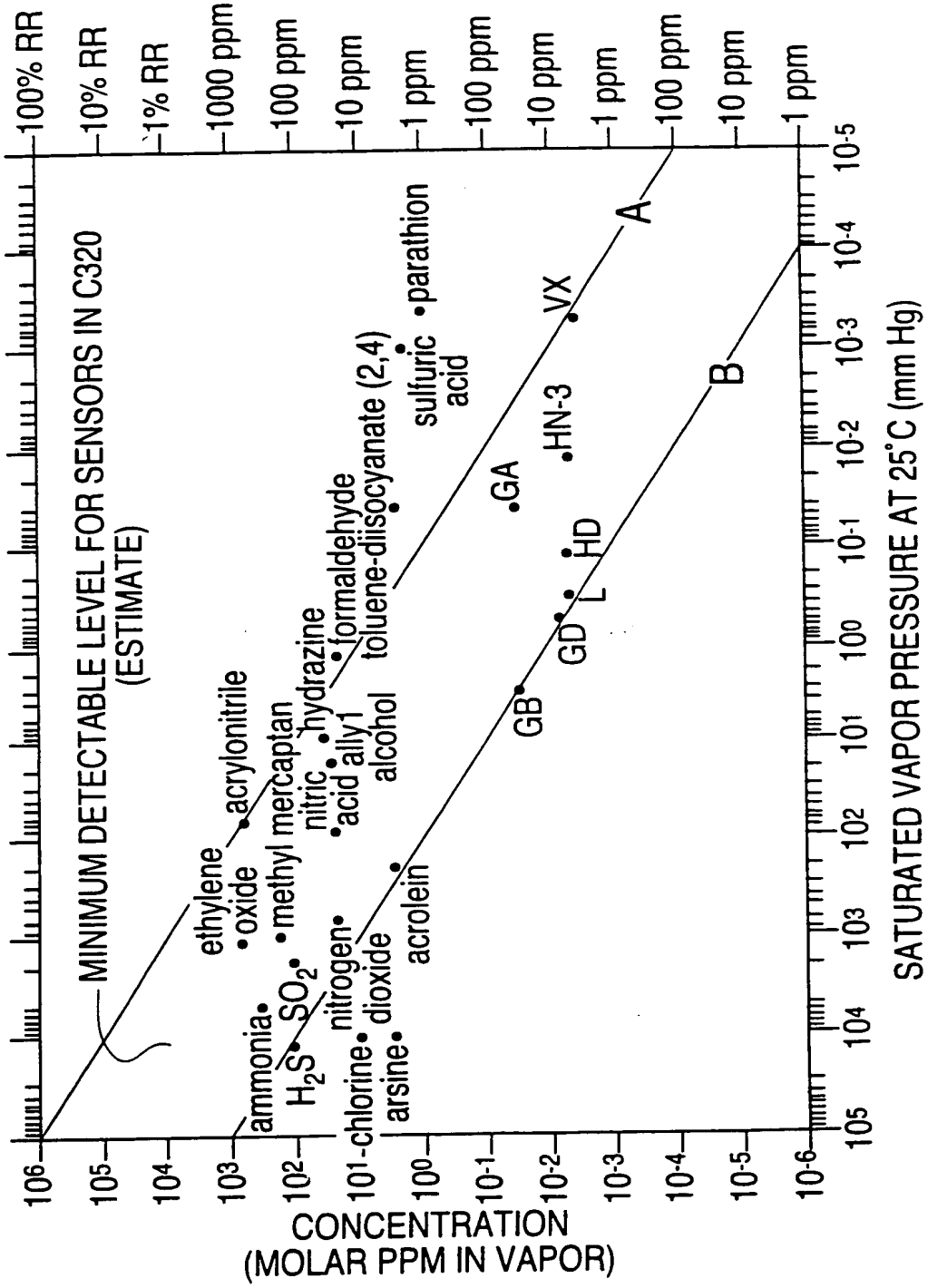
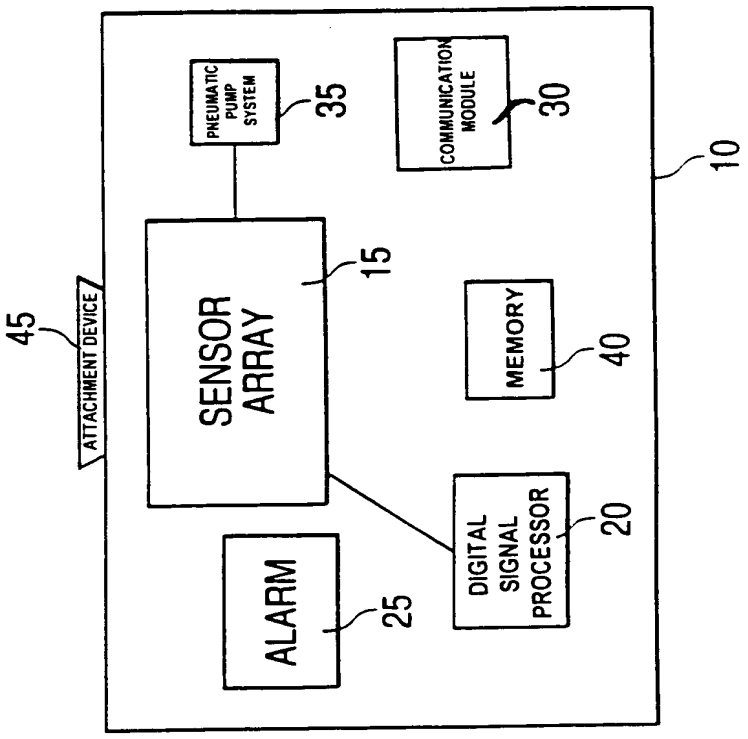

MINIMUM DETECTABLE LEVEL FOR SENSORS IN C320
(ESTIMATE)
100% RR
10% RR
1% RR
1000 ppm
100 ppm
10 ppm
1 ppm
100 ppm
10 ppm
1 ppm
100 ppm
10 ppm
1 ppm
ethylene oxide
acrylonitrile
methyl mercaptan
nitric acid
hydrazine
allyl alcohol
formaldehyde
toluene-diisocyanate (2,4)
sulfuric acid
parathion
ammonia
H_2S
SO_2
nitrogen dioxide
acrolein
GB
GD
L
HD
GA
HN-3
VX
A
B
CONCENTRATION
(MOLAR PPM IN VAPOR)
SATURATED VAPOR PRESSURE AT 25°C (mm Hg)

FIG. 3a


PNEUMATIC PUMP SYSTEM
35
COMMUNICATION MODULE
30
10
SENSOR ARRAY
15
45
ATTACHMENT DEVICE
MEMORY
40
DIGITAL SIGNAL PROCESSOR
20
ALARM
25

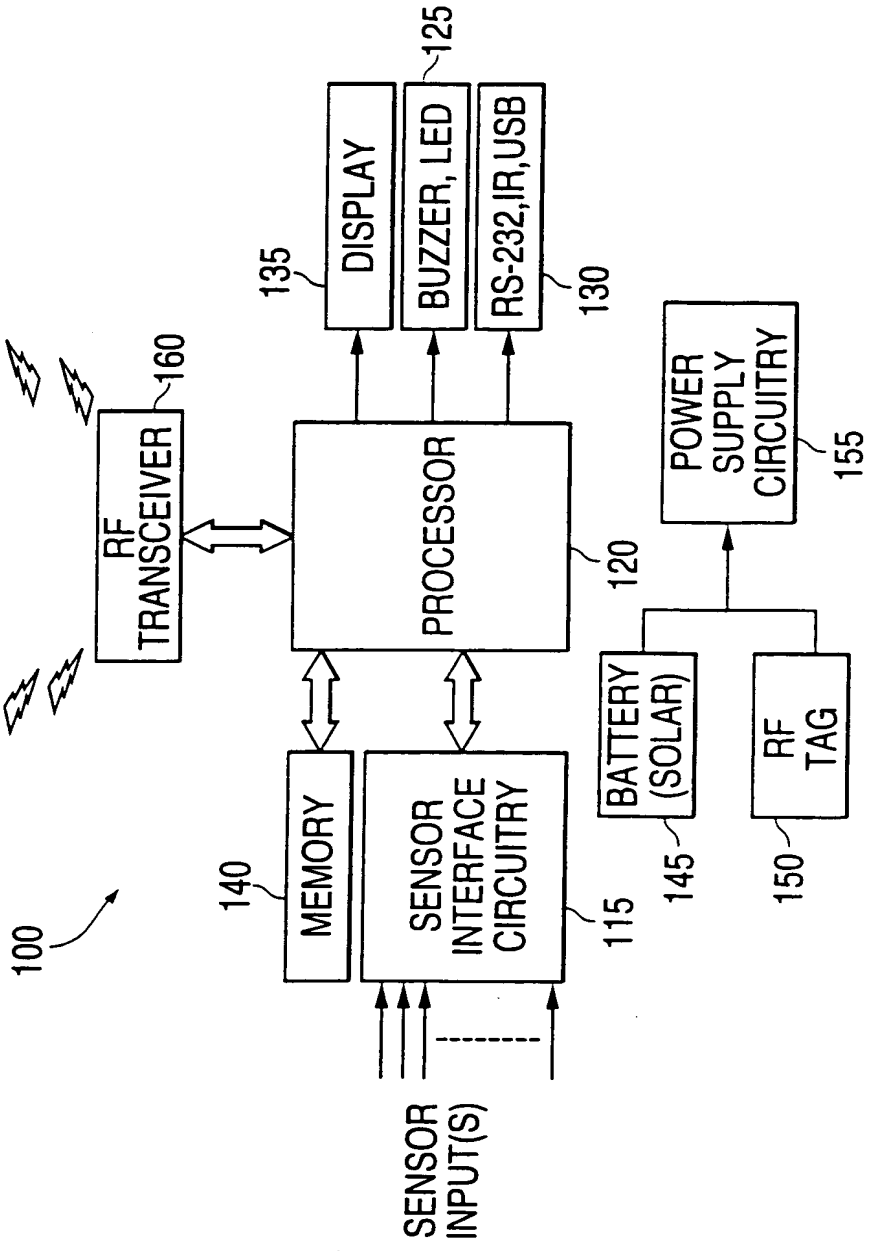

100
SENSOR INPUT(S)
SENSOR INTERFACE CIRCUITRY
115
MEMORY
140
PROCESSOR
120
RF TRANSCEIVER
160
DISPLAY
135
BUZZER, LED
125
RS-232,IR,USB
130
POWER SUPPLY CIRCUITRY
155
BATTERY (SOLAR)
145
RF TAG
150

FIG. 3b

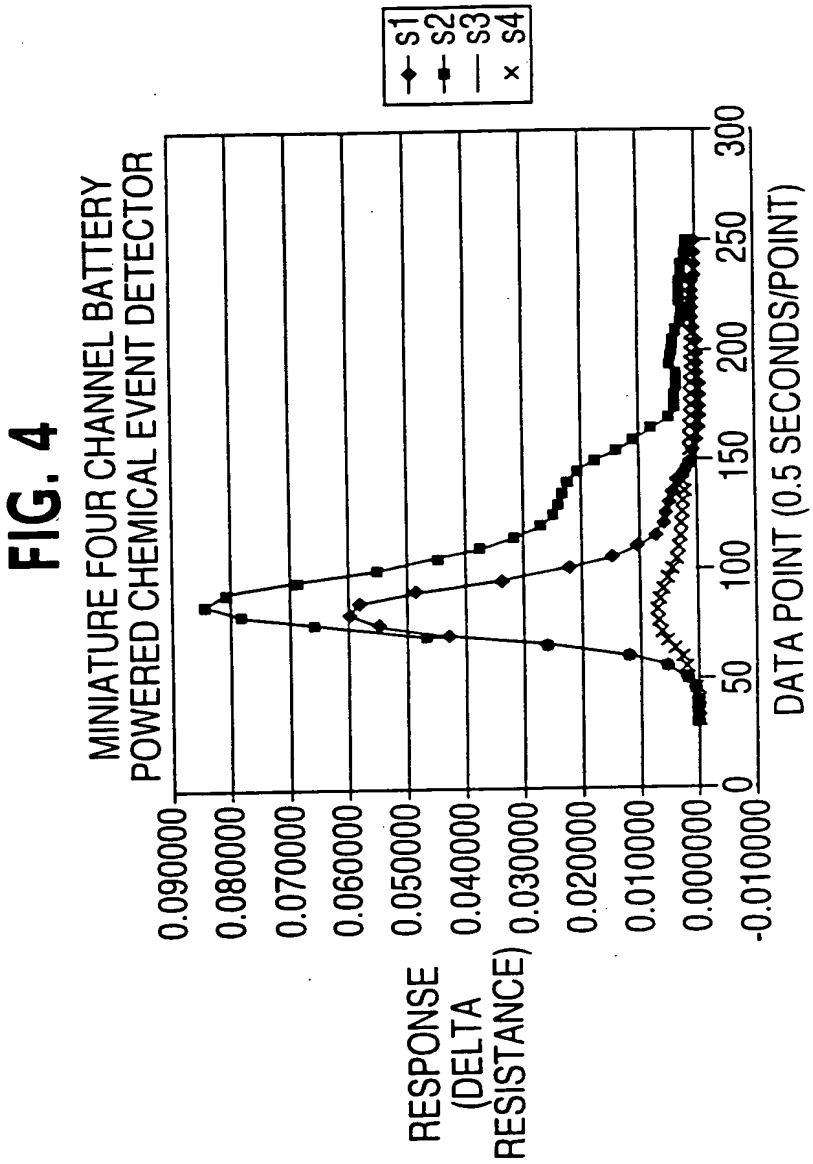

MINIATURE FOUR CHANNEL BATTERY POWERED CHEMICAL EVENT DETECTOR
RESPONSE (DELTA RESISTANCE)
0.090000
0.080000
0.070000
0.060000
0.050000
0.040000
0.030000
0.020000
0.010000
0.000000
-0.010000
0
50
100
150
200
250
300
DATA POINT (0.5 SECONDS/POINT)
s1
s2
s3
s4

FIG. 4

FIG. 5

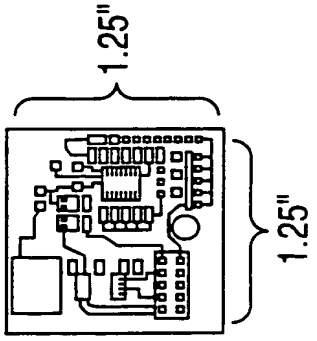


FIG. 6

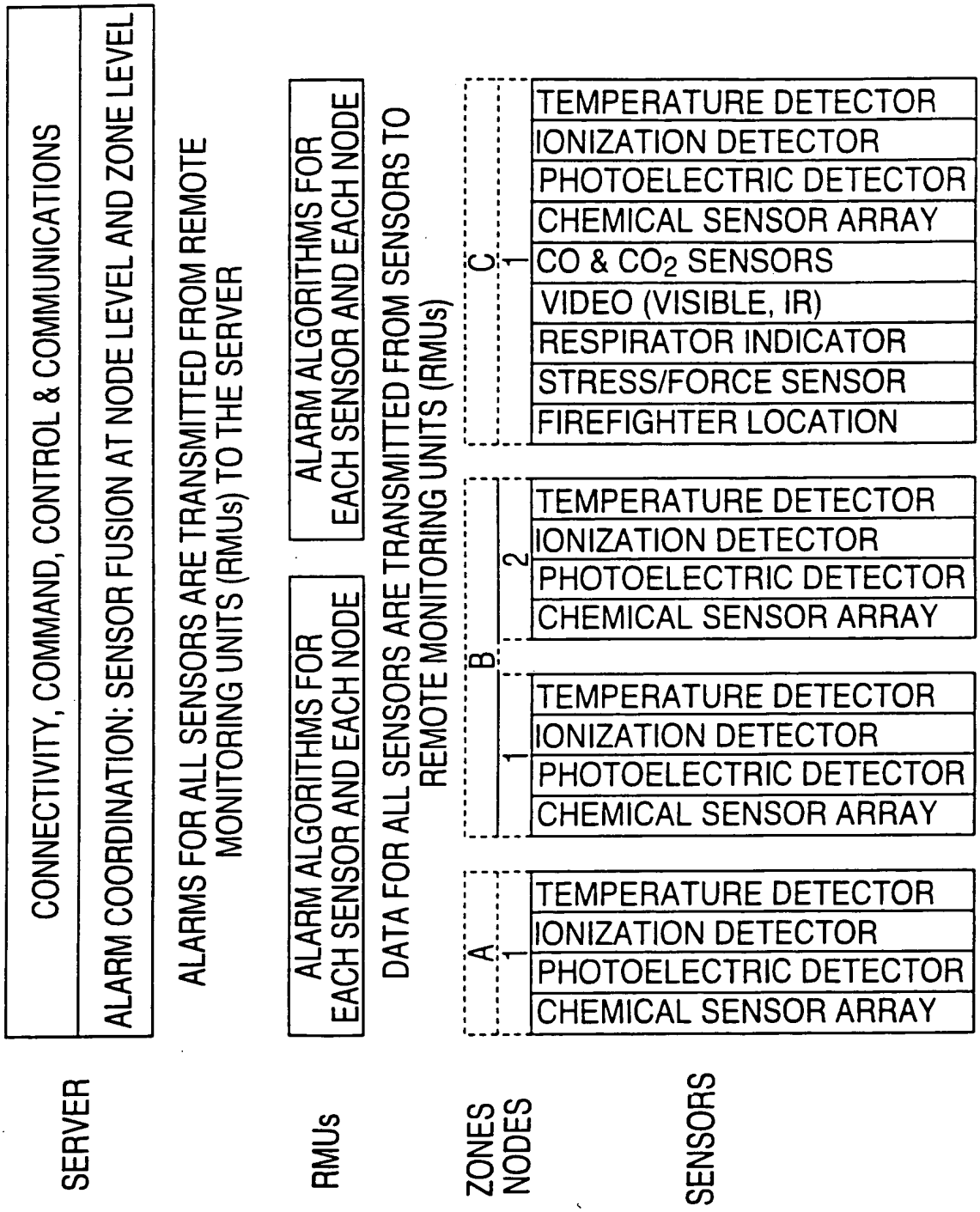
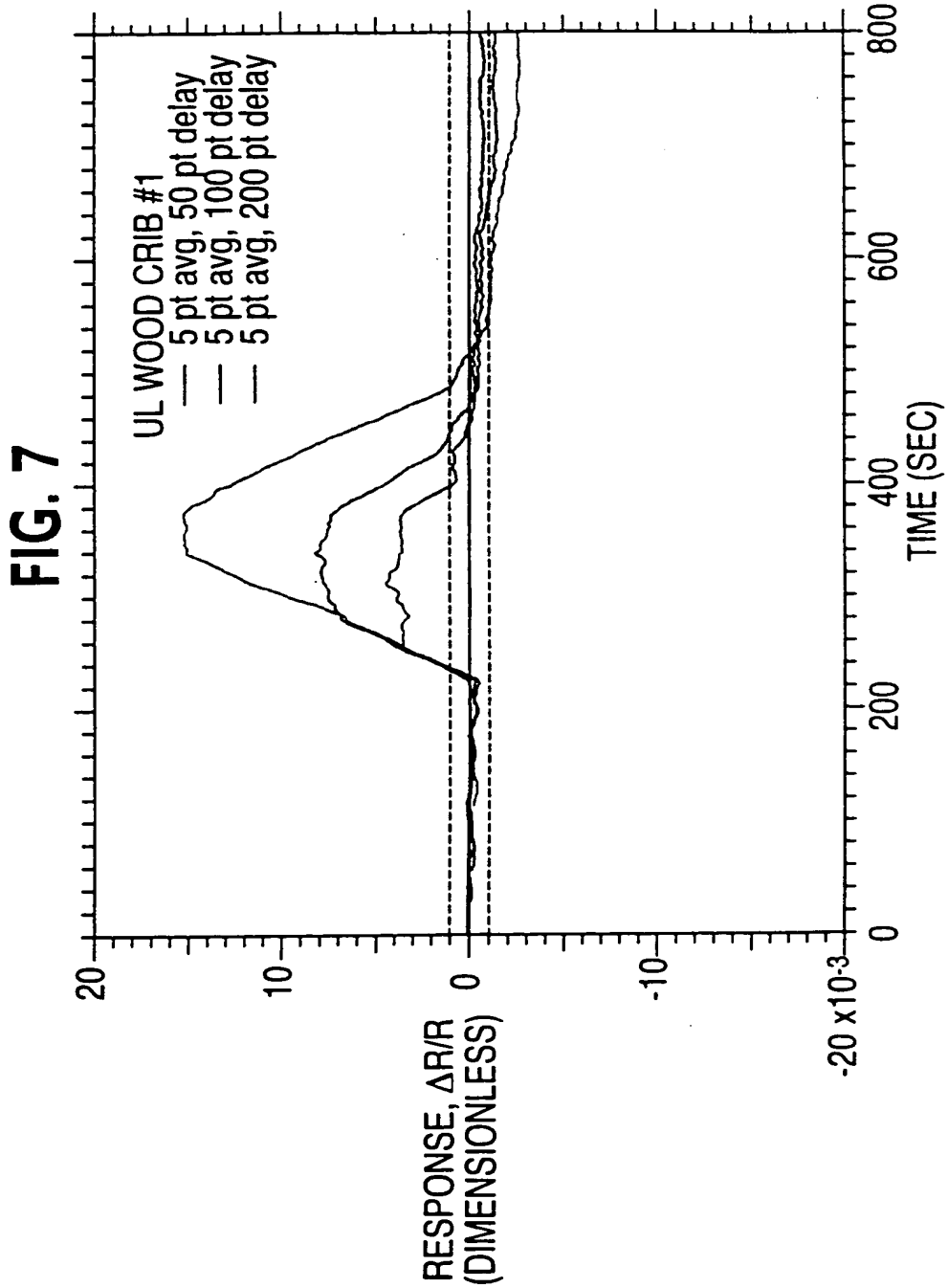

SERVER
CONNECTIVITY, COMMAND, CONTROL & COMMUNICATIONS
ALARM COORDINATION: SENSOR FUSION AT NODE LEVEL AND ZONE LEVEL
ALARMS FOR ALL SENSORS ARE TRANSMITTED FROM REMOTE MONITORING UNITS (RMUs) TO THE SERVER
RMUs
ALARM ALGORITHMS FOR EACH SENSOR AND EACH NODE
ALARM ALGORITHMS FOR EACH SENSOR AND EACH NODE
DATA FOR ALL SENSORS ARE TRANSMITTED FROM SENSORS TO REMOTE MONITORING UNITS (RMUs)
ZONES NODES
SENSORS
A
1
TEMPERATURE DETECTOR
IONIZATION DETECTOR
PHOTOELECTRIC DETECTOR
CHEMICAL SENSOR ARRAY
B
1
TEMPERATURE DETECTOR
IONIZATION DETECTOR
PHOTOELECTRIC DETECTOR
CHEMICAL SENSOR ARRAY
2
TEMPERATURE DETECTOR
IONIZATION DETECTOR
PHOTOELECTRIC DETECTOR
CHEMICAL SENSOR ARRAY
C
1
TEMPERATURE DETECTOR
IONIZATION DETECTOR
PHOTOELECTRIC DETECTOR
CHEMICAL SENSOR ARRAY
CO & CO_2 SENSORS
VIDEO (VISIBLE, IR)
RESPIRATOR INDICATOR
STRESS/FORCE SENSOR
FIREFIGHTER LOCATION

FIG. 7


UL WOOD CRIB #1
5 pt avg, 50 pt delay
5 pt avg, 100 pt delay
5 pt avg, 200 pt delay
RESPONSE, ΔR/R (DIMENSIONLESS)
20
10
0
-10
-20 x10-3
0
200
400
600
800
TIME (SEC)

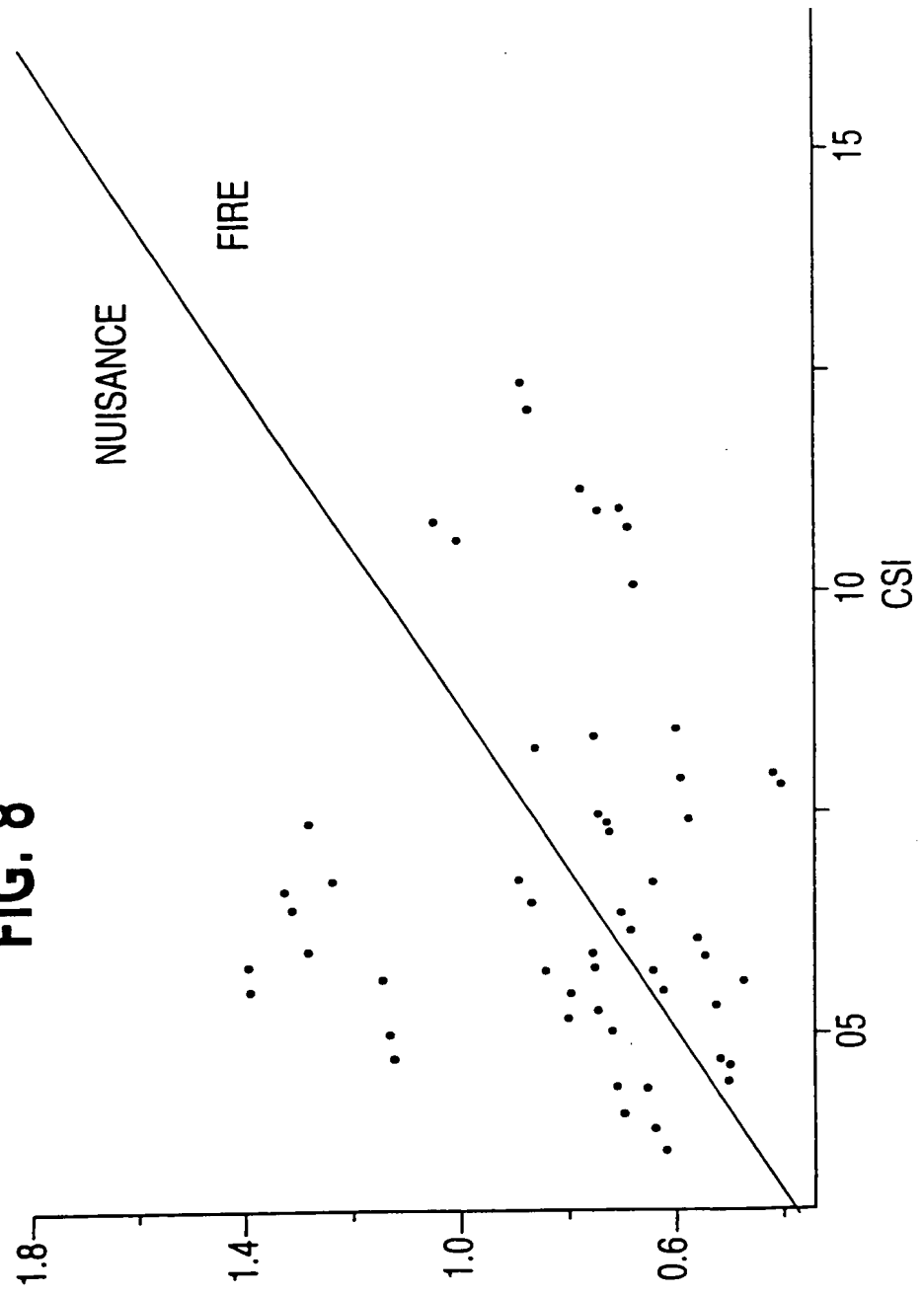


FIG. 8

FIG. 9

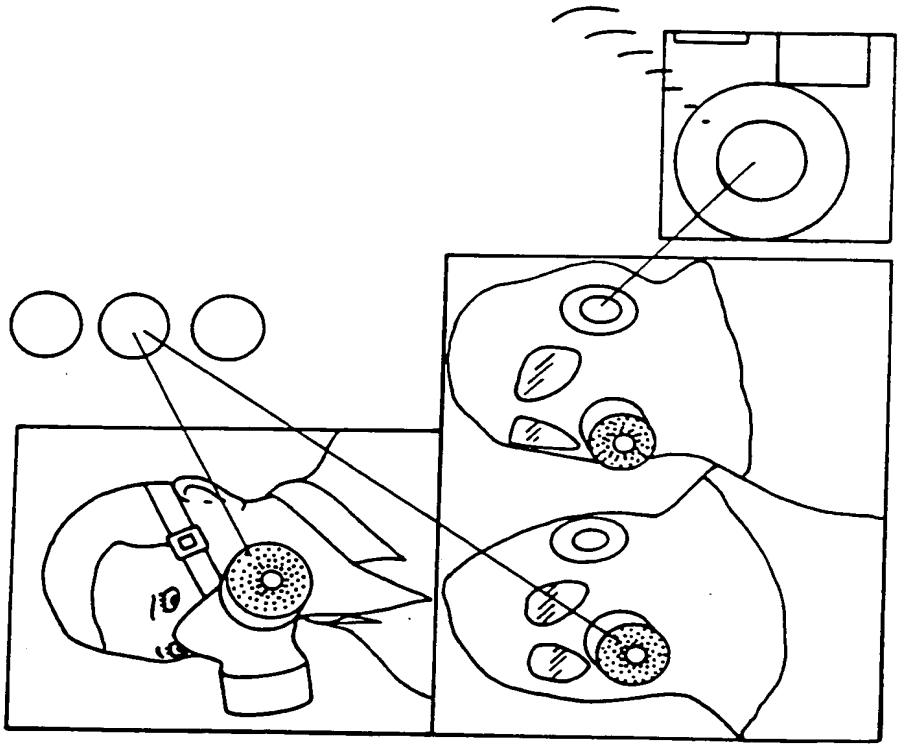


FIG. 10

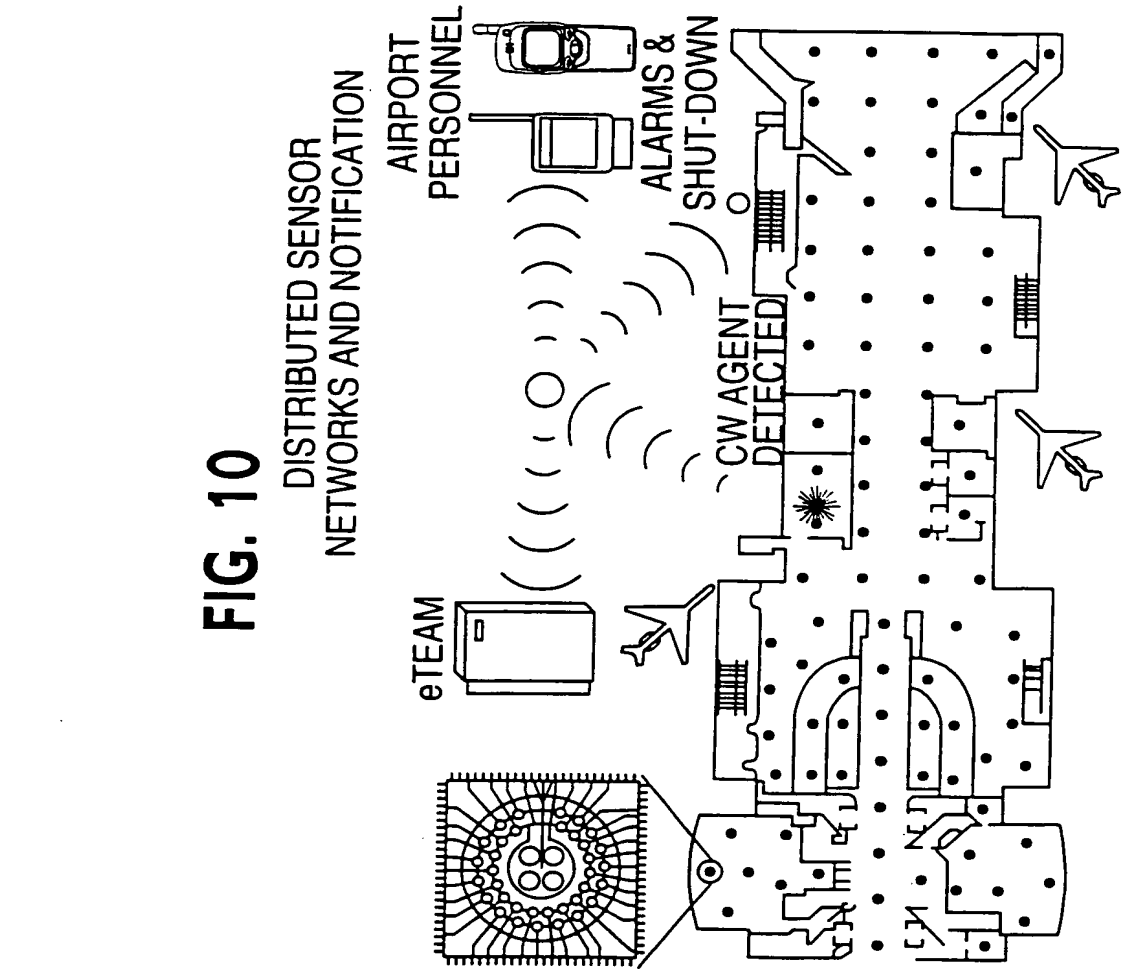

DISTRIBUTED SENSOR
NETWORKS AND NOTIFICATION
AIRPORT
PERSONNEL
ALARMS &
SHUT-DOWN
CW AGENT
DETECTED
eTEAM

FIG. 11

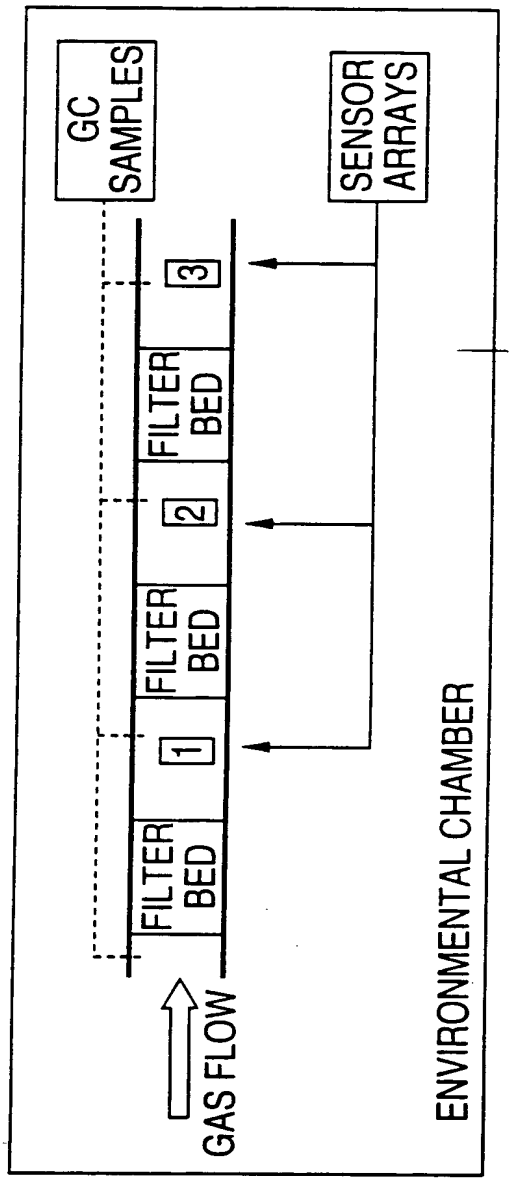

GC SAMPLES
SENSOR ARRAYS
FILTER BED
1
FILTER BED
2
FILTER BED
3
GAS FLOW
ENVIRONMENTAL CHAMBER

FIG. 12

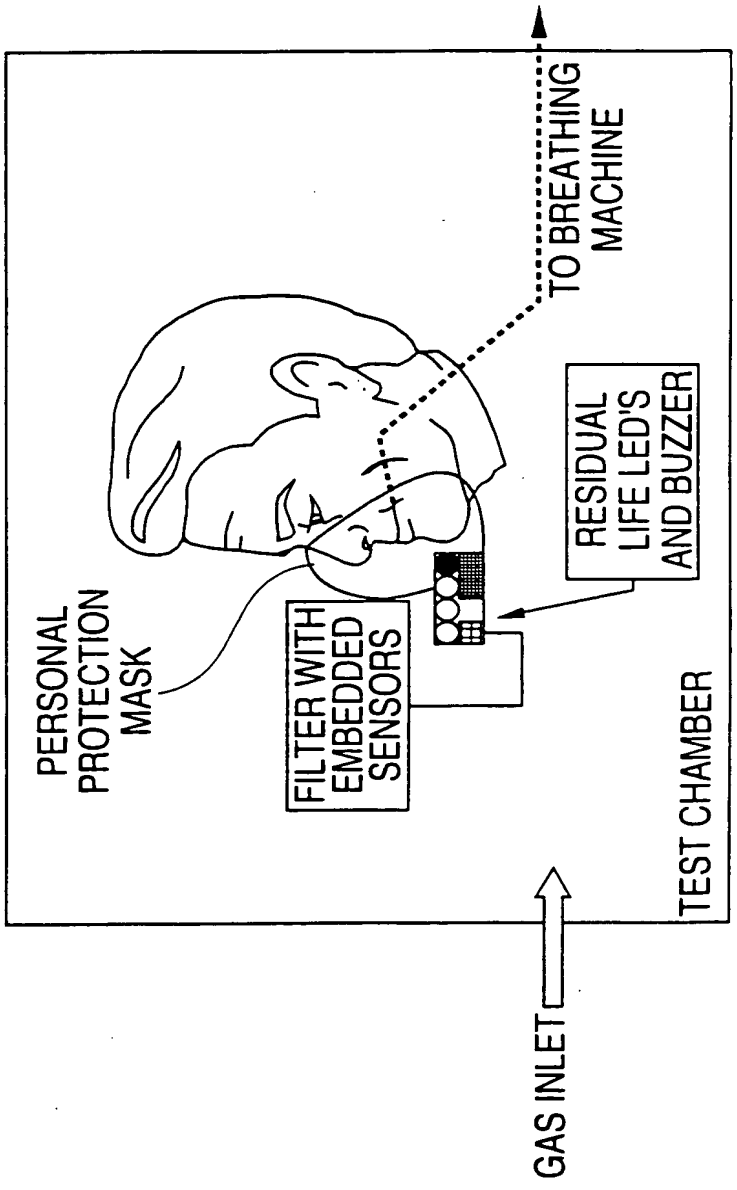

TO BREATHING MACHINE
RESIDUAL LIFE LED'S AND BUZZER
PERSONAL PROTECTION MASK
FILTER WITH EMBEDDED SENSORS
TEST CHAMBER
GAS INLET

FIG. 13

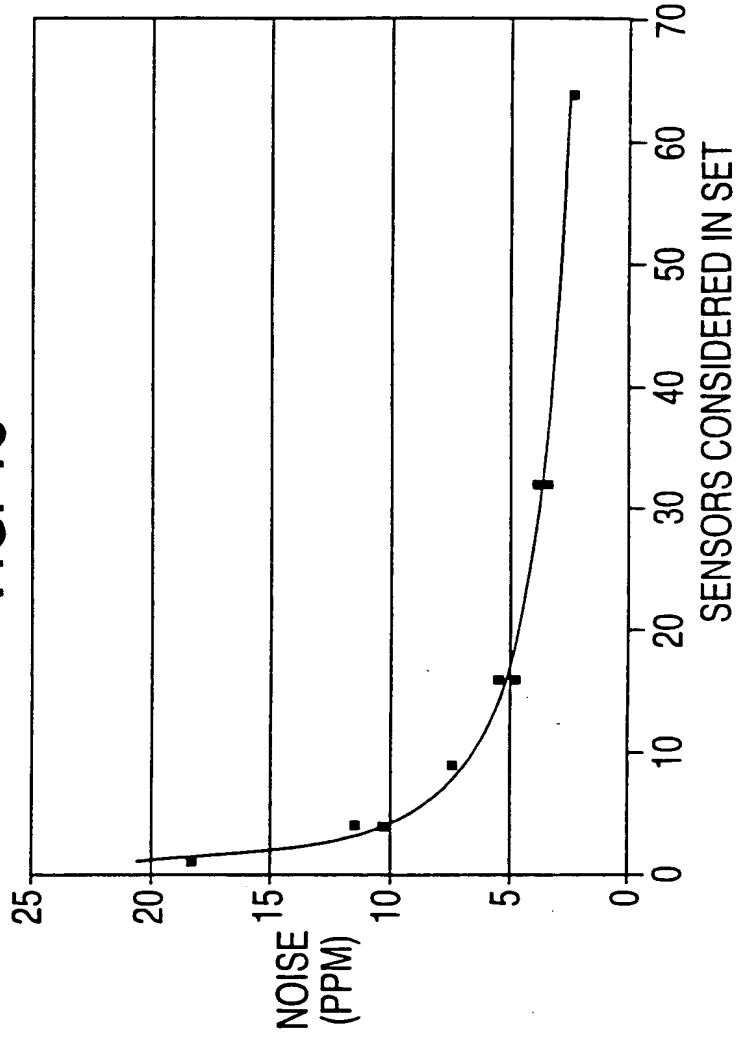

NOISE (PPM)
25
20
15
10
5
0
0
10
20
30
40
50
60
70
SENSORS CONSIDERED IN SET

FIG. 14

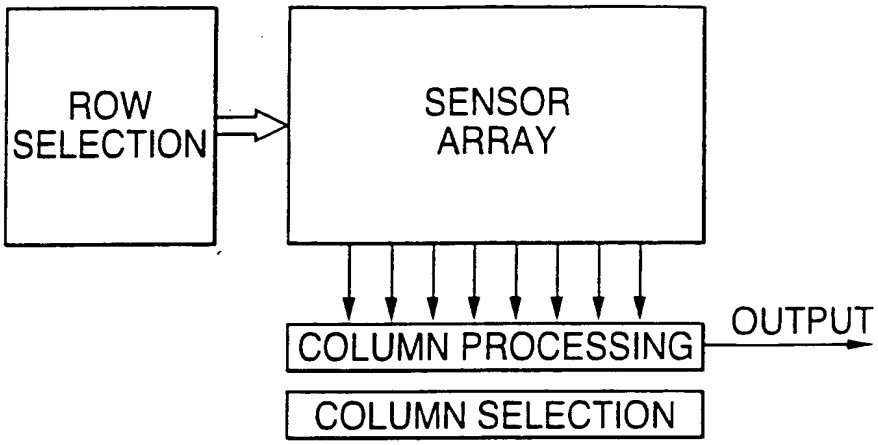

ROW SELECTION
SENSOR ARRAY
OUTPUT
COLUMN PROCESSING
COLUMN SELECTION

FIG. 15

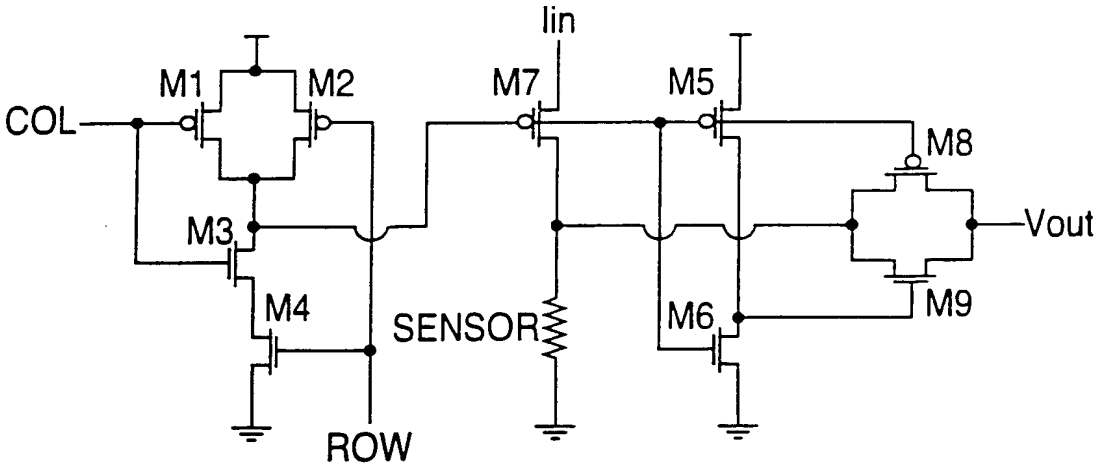

Iin
M1
M2
M7
M5
COL
M8
M3
Vout
M4
SENSOR
M6
M9
ROW

FIG. 16

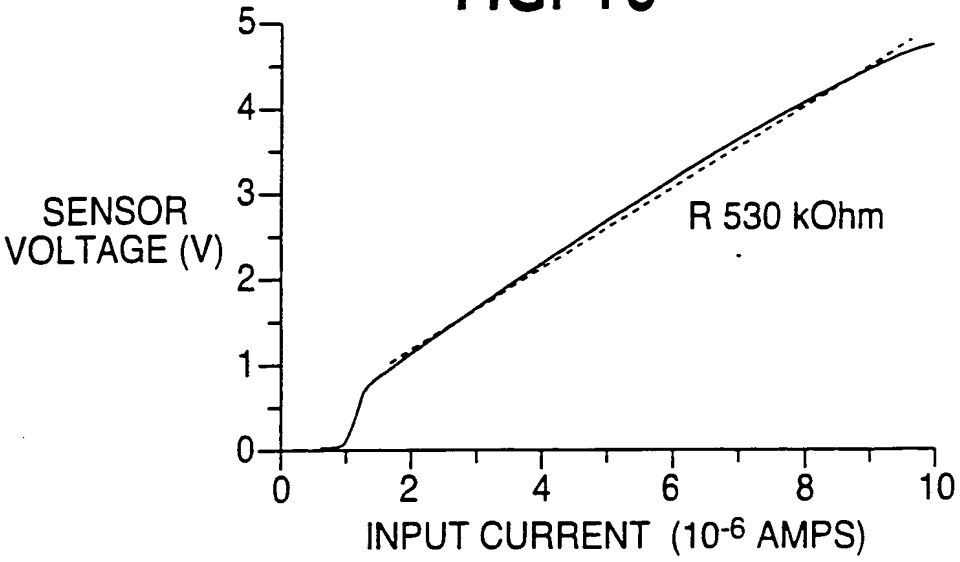

SENSOR VOLTAGE (V)
5
4
3
2
1
0
R 530 kOhm
0
2
4
6
8
10
INPUT CURRENT (10-6 AMPS)

FIG. 17

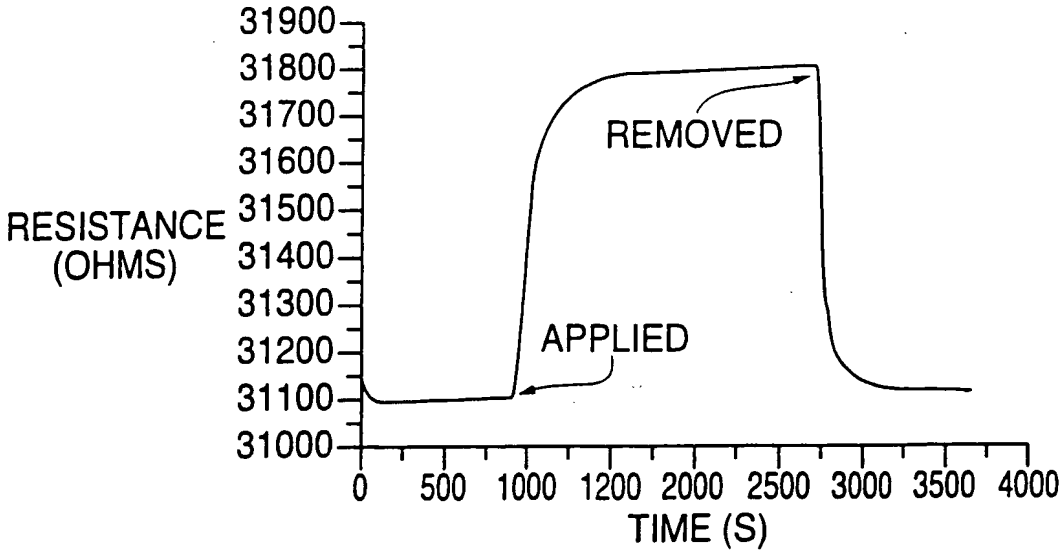

RESISTANCE (OHMS)
31900
31800
31700
31600
31500
31400
31300
31200
31100
31000
REMOVED
APPLIED
0
500
1000
1200
2000
2500
3000
3500
4000
TIME (S)

FIG. 18

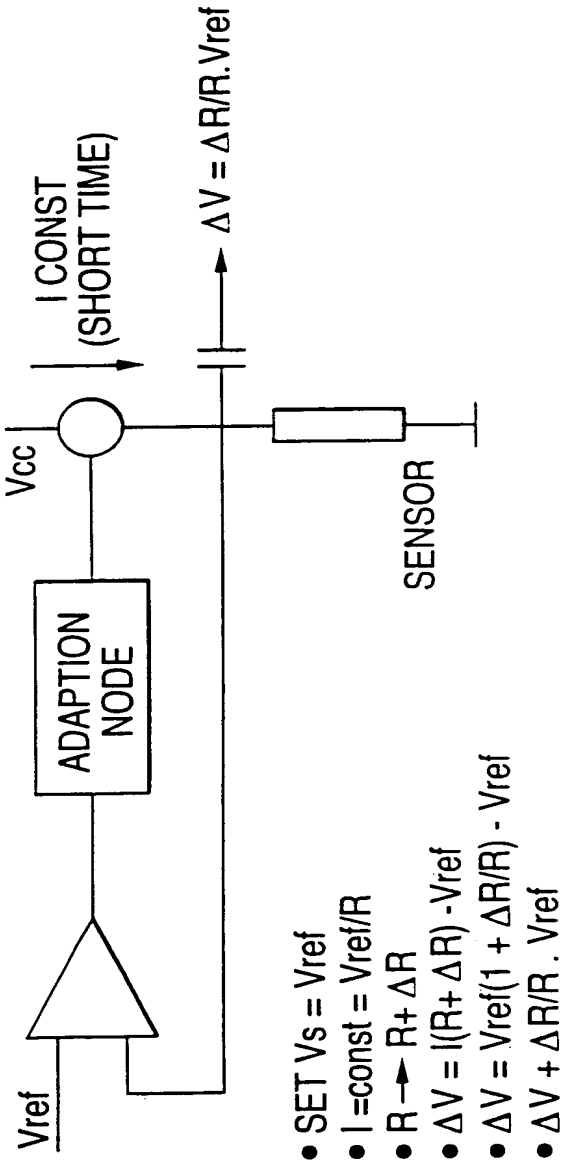

I CONST
(SHORT TIME)
ΔV = ΔR/R.Vref
Vcc
ADAPTION
NODE
SENSOR
Vref
• SET Vs = Vref
• I =const = Vref/R
• R → R+ ΔR
• ΔV = I(R+ ΔR) -Vref
• ΔV = Vref(1 + ΔR/R) - Vref
• ΔV + ΔR/R . Vref

FIG. 19

Sample #	Treatment	Solvents	Particle Size nm
6537-57b	Poly(isobutylene) on BP700	Isopar G	150
8847-9a	Polypropylene glycol on BP700	Xylene	180
6537-40	Poly(acrylic ester) on BP700	Ethanol	210
6537-51	Poly(acrylic acid) on BP700	water	210

FIG. 20a

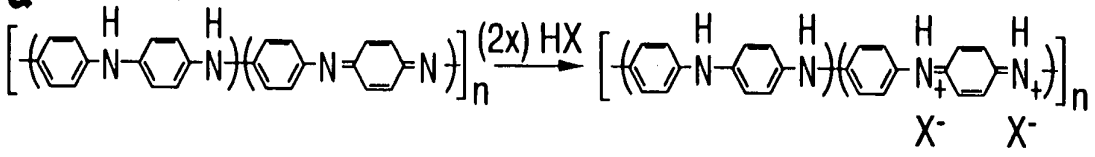


FIG. 20b

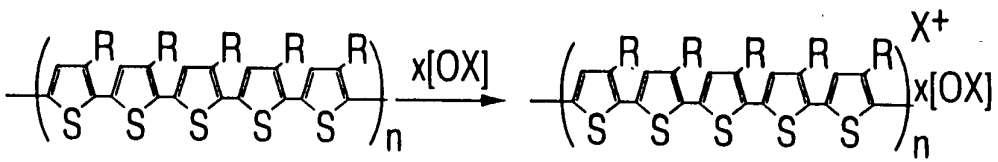
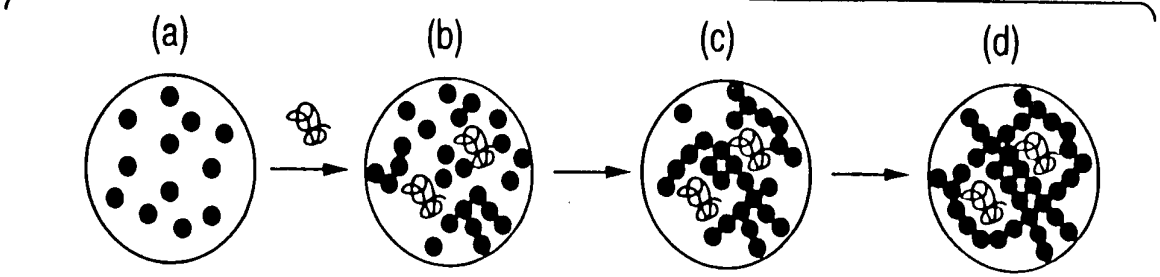
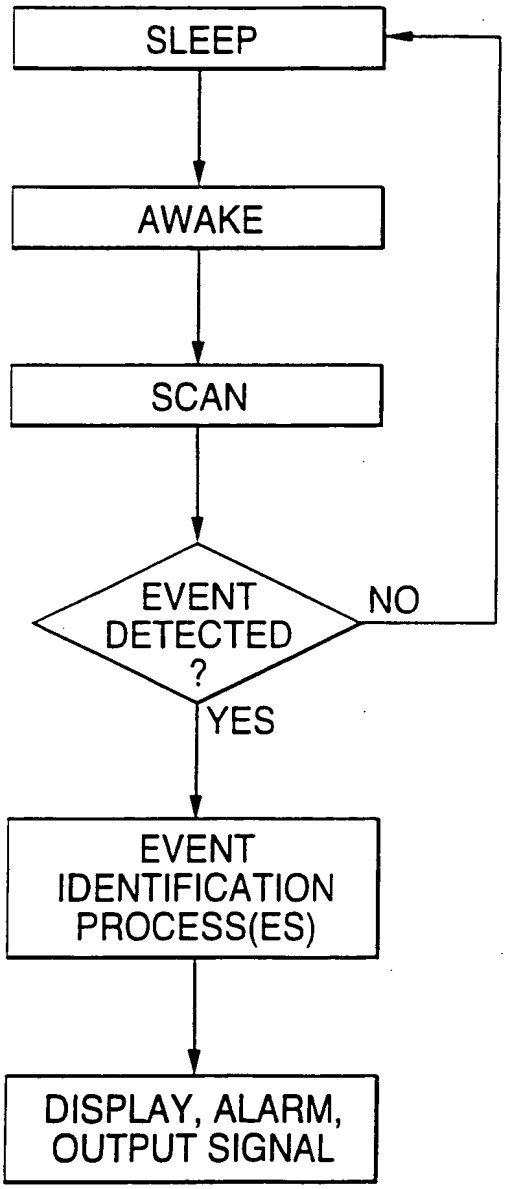


FIG. 21



Title: NON-SPECIFIC SENSOR ARRAY DETECTORS
Inventor(s): Gregory STEINTHAL et al.
Appl. No.: 10/624,194

FIG. 22


SLEEP
AWAKE
SCAN
EVENT DETECTED ?
NO
YES
EVENT IDENTIFICATION PROCESS(ES)
DISPLAY, ALARM, OUTPUT SIGNAL

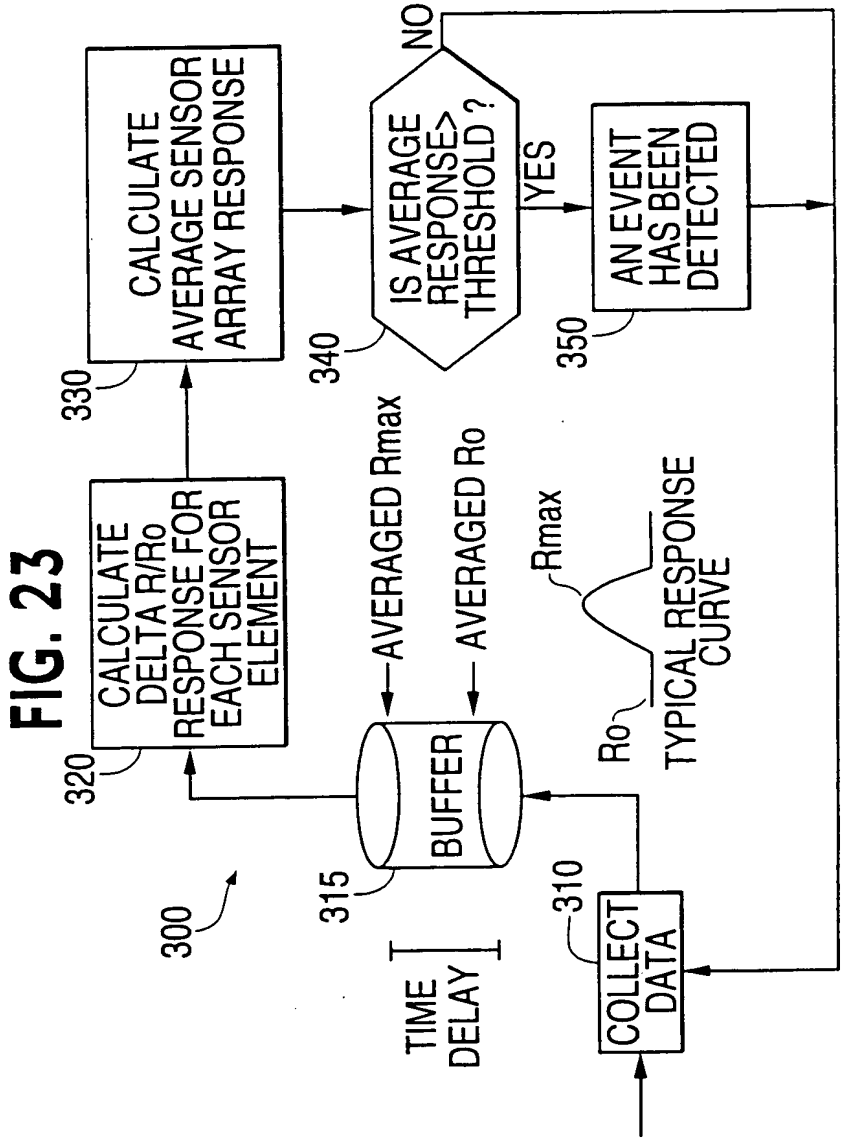

300
COLLECT DATA
310
TIME DELAY
BUFFER
315
AVERAGED Rmax
AVERAGED Ro
Rmax
Ro
TYPICAL RESPONSE CURVE
CALCULATE DELTA R/Ro RESPONSE FOR EACH SENSOR ELEMENT
320
CALCULATE AVERAGE SENSOR ARRAY RESPONSE
330
IS AVERAGE RESPONSE> THRESHOLD ?
340
NO
YES
AN EVENT HAS BEEN DETECTED
350

FIG. 23